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(54) Improvements in or relating to bearings

(57) A device for extracting energy from waves by use of the relative alternating angular motion between two members 13, 15 in response to waves, has a bearing provided by a number of pads 30 each having an orifice 40 communicating with a collapsible liquid-filled chamber 27. Under the effect of a load on any of the chambers 27, the collapse of the chambers 27 forces the liquid between the respective pads 30 and a bearing surface 44 of one of the members. On reversal of the load causing extension of the chambers 27, the liquid is sucked into the chamber 27 through respective inlet ports 23, or liquid may be injected into chamber 27 by an external pressurized source.

Fig.3.

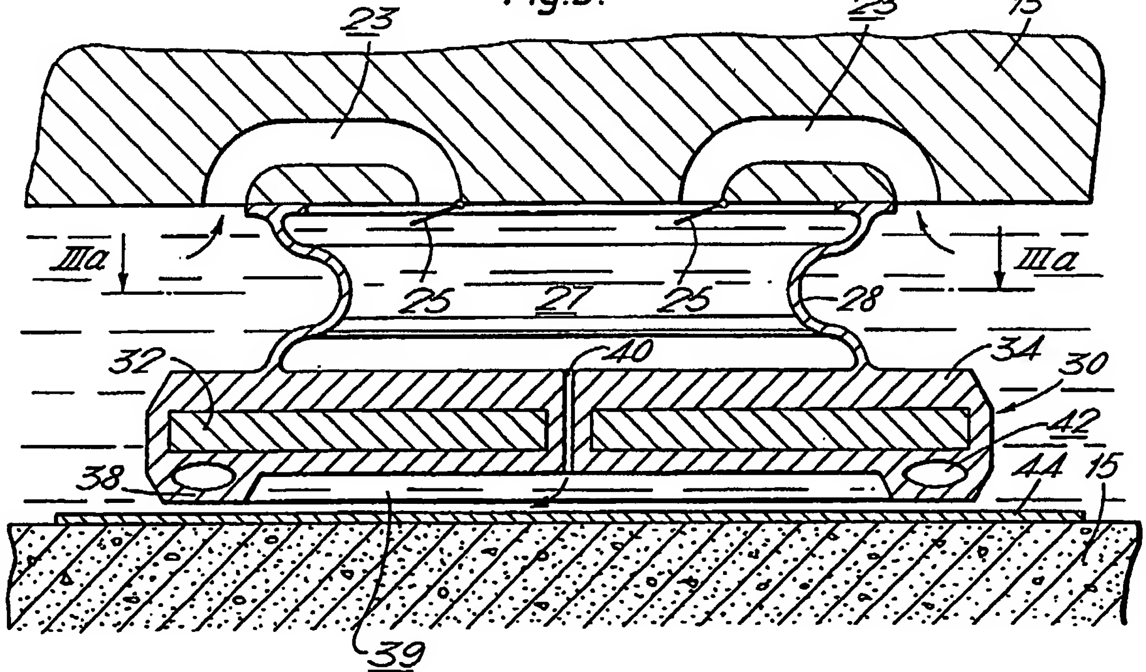

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Fig. 1.

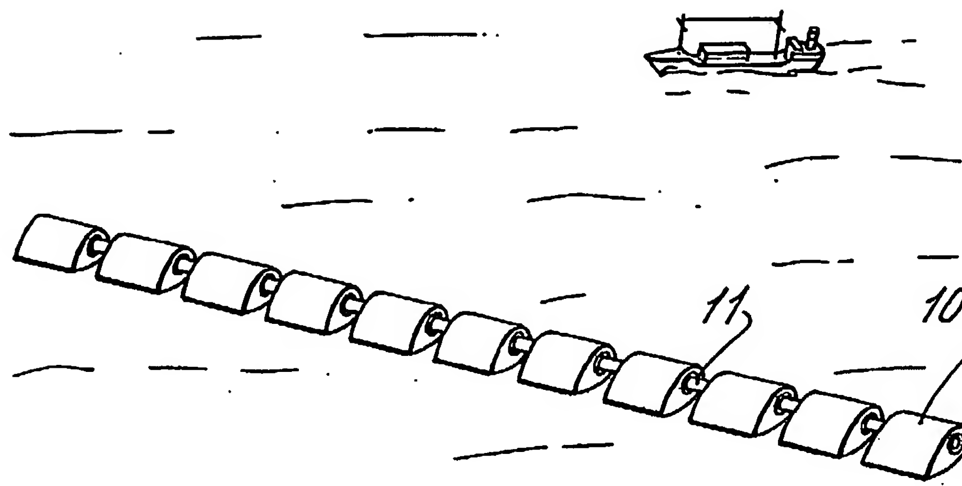
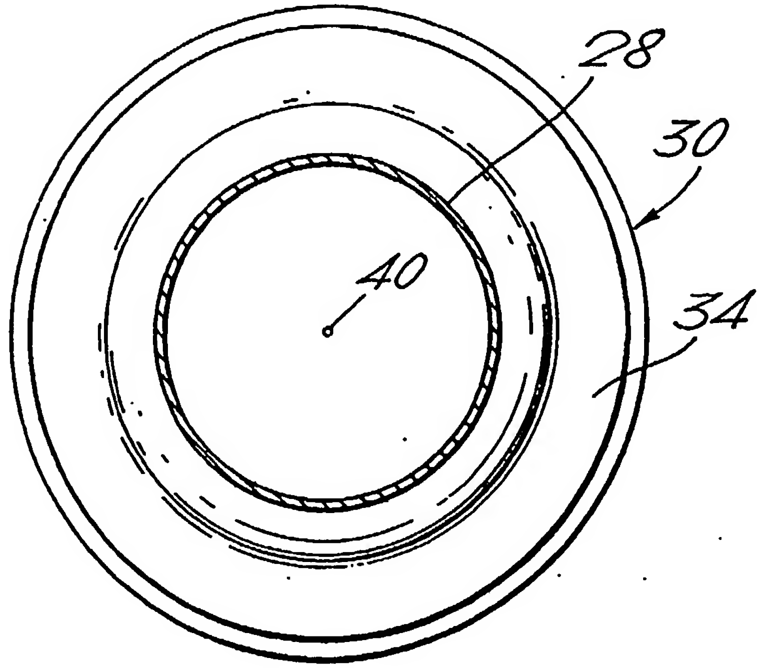


Fig. 3a.



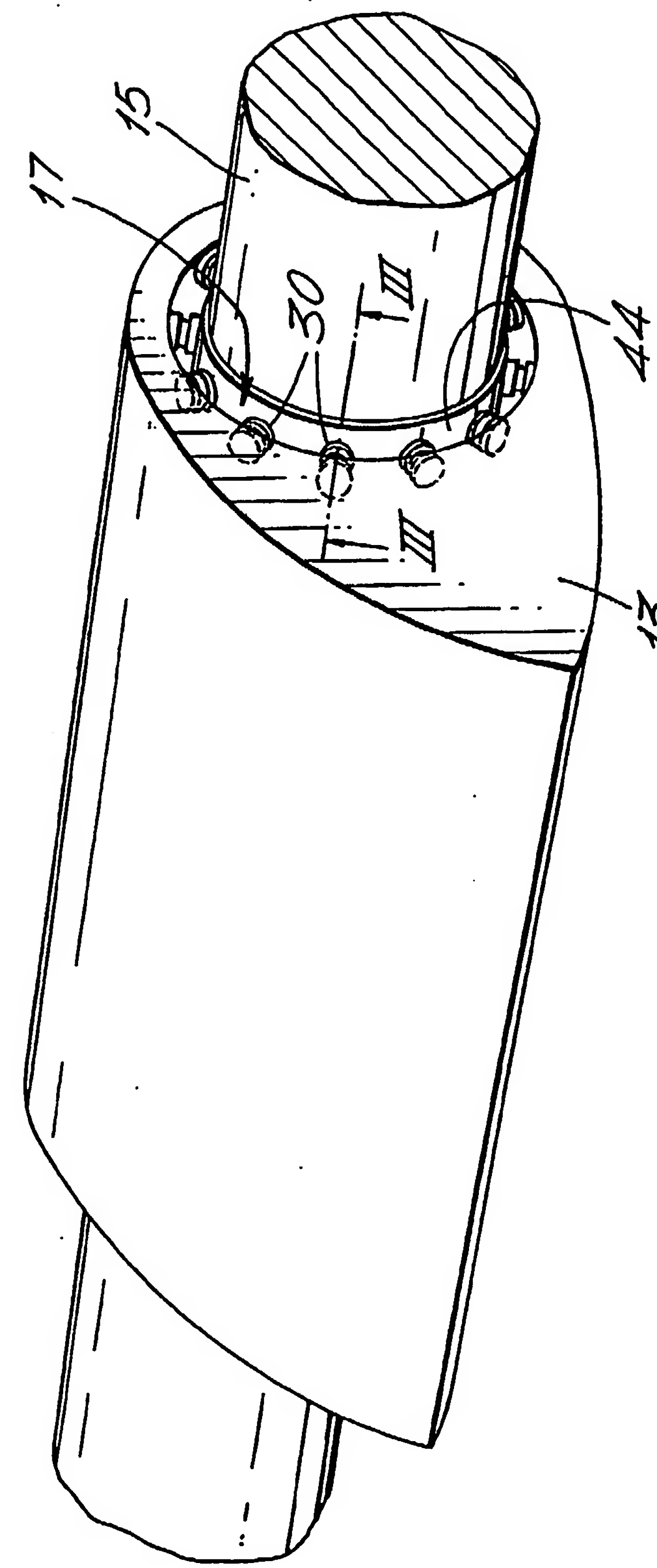


Fig.2.

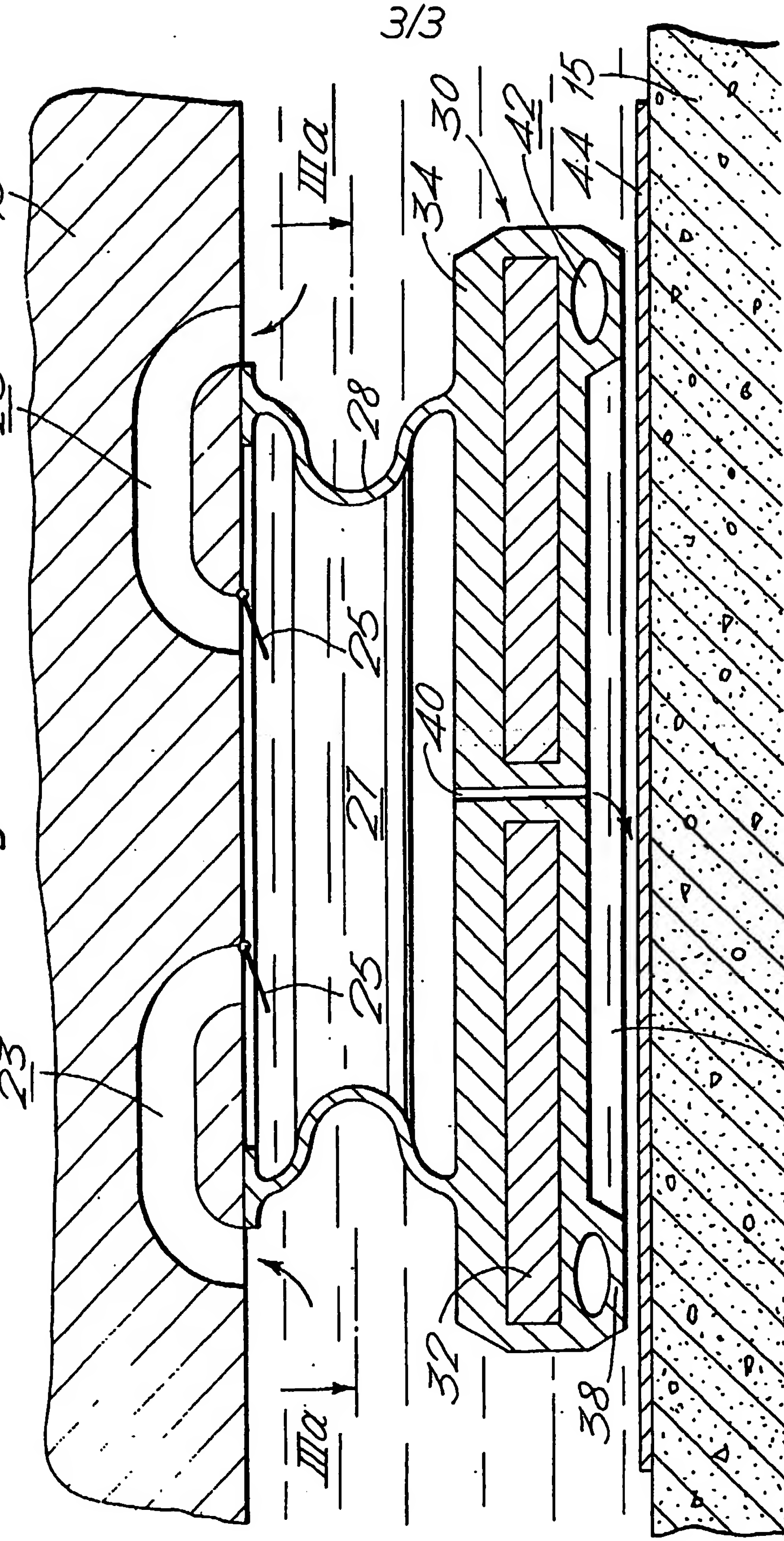


Fig.3.

SPECIFICATION

Improvements in or relating to bearings

This invention relates to bearings and more particularly but not exclusively, to bearings for energy from waves on a liquid, for example the Salter Duck, the subject of British Patent No. 1,482,085 (United States Patent No. 3,928,967) which is incorporated by reference herein.

An article entitled "Power from the Waves" by M. B. Holland, appeared in the Chartered Mechanical Engineer, September 1978, published by the Institution of Mechanical Engineers, London, England, and examined the potential of wave power around the United Kingdom, the Salter Duck being among the devices described in this article.

One problem common to many wave energy devices is that of providing a bearing having a relativel/ low co-efficient of friction and capable of coping with reversing velocities over a relatively long working life.

According to the present invention, there is provided a bearing comprising a plurality of hollow bodies to be disposed about a bearing surface, each body defining a chamber therein and being extensible so as to vary the volume of the chamber and having inlet means for a fluid into the chamber and a restricted outlet for the fluid from the chamber to a bearing portion of the body, the bearing portion being arranged so as to be disposed in use adjacent to the bearing surface, whereby under the effect of a load on a said body in a direction towards the bearing surface, the fluid is ejected from the chamber thereof through the restricted outlet to flow between the bearing portion of said body and the bearing surface.

Preferably, the bearing portion of a said body is of greater surface area in a direction parallel to the bearing surface than the corresponding cross-sectional area of the chamber thereof.

Desirably, the bearing portion comprises a resilient pad, the pad being shaped to define an annular lip at or near the periphery of the bearing portion. Furthermore, an annular voidage may be defined in the pad behind the lip.

The bodies may be distributed around an annular space between two members to be subjected to reversing relative angular velocities, one of the members comprising the bearing surface.

The fluid may be drawn into the respective chamber through the inlet means thereof by reversal of the load on the body, or may be injected into the chamber by an external source of fluid pressure.

The invention will now be further described by way of example only with reference to the accompanying drawings in which:—

Figure 1 shows a perspective representation of a string of Salter Ducks;

Figure 2 shows to an enlarged scale a Salter Duck of Figure 1;

Figure 3 shows to an enlarged scale a sectional view on the line III—III of Figure 2; and

Figure 3*a* shows to a reduced scale a sectional view on the line III*a*—III*a* of Figure 3.

Referring now to Figure 1, a string of Salter Ducks 10 are shown pivotally supported on a spine 11, each Salter Duck 10 as shown in Figure 2 essentially comprising a pivotable member 13 about a spine portion 15. A bearing 17 is provided between the spine portion 15 and the pivotable member 13 as shown in more detail in Figures 3 and 3*a* to which reference is made. Circumferentially distributed pairs of axially aligned ducts 23 (only one pair is shown) are provided in the pivotable member 13, each pair of ducts 23 having outlet non-return valves 25 at one end for discharge into a respective chamber 27 which has an extensible corrugated tubular wall 28 of a reinforced elastomeric material (e.g. rubber). The wall 28 extends at one end thereof from the pivotable member 13 and at the other end thereof is joined to one end of a resilient pad 30 comprising an annular backing disc 32 (e.g. metal) embedded in a body 34 of the same elastomer as that of the wall 28. An annular land 38 extends around the other end of the pad 30 to define a cavity 39, and a small-bore tube 40 extends centrally through the pad 30 to connect the chamber 27 to the cavity 39. An annular voidage 42 of oval cross-section is defined by the pad 30 behind the land 38 so as to provide a degree of flexibility at the land 38. Each duct 23 has an inlet 42 positioned outside the wall 28 so as to suck in seawater around the wall 28. A thin band 44 of cupro-nickel is bonded around the spine portion 15.

In operation, with the chamber 27 filled with seawater, at one side of the spine portion 15 a radial load is applied by the pivotable member 13 towards the spine portion 15. This radial load is transmitted to the wall which collapses under the load, and seawater is forced through the tube 40 into the cavity 39, and thus between the land 38 and the band 44. On reversal of the radial load the wall 28 is extended causing seawater to be drawn through the ducts 23 into the chamber 27.

Under the effect of the radial load the pressure inside the chamber 27 is greater than the pressure under the pad 30 since the pad 30 is of greater diameter, and the restriction imposed by the tube 40 and the impedance of the gap between the land 38 and the band 44 govern the rate of flow of seawater out of the chamber 27.

In an alternative arrangement, a chamber 27 marginally greater in diameter than that of the pad 30 might be used, a small fraction of the radial load being taken by the land 38 although the leakage rate would be much reduced and the arrangement working as a friction coefficient attenuator rather than a true hydrostatic bearing.

Although a semi-rigid pad 30 has been shown, a more flexible pad reinforced with a fibrous material might be used, it being understood that the pad should conform to the peripheral shape of the band 44 when under load.

The bearing of the invention may be used in other devices subject to moderate reversing

velocities. Although a submerged application of the bearing is preferred, an arrangement in which an external source of fluid pressure is delivered to the chamber 27 might be used.

CLAIMS

1. A bearing comprising a plurality of hollow bodies to be disposed about a bearing surface, each body defining a chamber therein and being extensible so as to vary the volume of the chamber and having inlet means for a fluid into the chamber and a restricted outlet for the fluid from the chamber to a bearing portion of the body, the bearing portion being arranged so as to be disposed in use adjacent to the bearing surface, whereby under the effect of a load on a said body in a direction towards the bearing surface, the fluid is ejected from the chamber thereof through the restricted outlet to flow between the bearing portion of said body and the bearing surface.

2. A bearing as claimed in Claim 1, wherein the bearing portion of a said body is of greater surface area in a direction parallel to the bearing surface than the corresponding cross-sectional area of the chamber thereof.

3. A bearing as claimed in Claim 1 or Claim 2, wherein the bearing portion comprises a resilient pad, the pad being shaped to define an annular lip at or near the periphery of the bearing portion.

4. A bearing as claimed in Claim 3, wherein an annular voidage is defined in the pad behind the lip.

5. A bearing as claimed in Claim 3 or Claim 4, wherein the pad comprises a metal disc encased in an elastomeric material.

6. A bearing as claimed in any one of the preceding Claims, wherein the fluid is arranged to be drawn into the chamber through the inlet means thereof by reversal of the load on the body.

7. A bearing as claimed in any one of Claims 1 to 5, wherein the fluid is arranged to be injected into the chamber by an external source of fluid pressure.

8. A bearing as claimed in any one of the preceding Claims, wherein the bodies are distributed around an annular space between two members to be subjected to reversing relative angular velocities, one of the members comprising the bearing surface.

9. A bearing as claimed in any one of the preceding Claims, wherein that portion of the body defining the chamber comprises reinforced elastomeric material.

10. A bearing substantially as hereinbefore described with reference to Figures 1 to 3*a* of the accompanying drawings.

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